



(19) Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) EP 0 882 581 A2

(12)

## EUROPEAN PATENT APPLICATION

(43) Date of publication:  
09.12.1998 Bulletin 1998/50

(51) Int. Cl.<sup>6</sup>: B41B 21/32, G03F 7/20

(21) Application number: 98110169.4

(22) Date of filing: 04.06.1998

(84) Designated Contracting States:  
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE  
Designated Extension States:  
AL LT LV MK RO SI

(30) Priority: 04.06.1997 US 868969

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### (54) Registration detection apparatus for imaging systems

(57) A registration apparatus for positioning a medium (10') on a media support surface (22), includes a moveable member (18 or 18') and a registration member (24 or 24'). The moveable member is contacted by an edge (10a) of a medium, and moves therewith as the medium is moved to a set position on the support sur-

face. The registration member restrains the movement of the moveable member, at the point at which the moveable member contacts the registration member, to position the medium at the set position on the support surface.

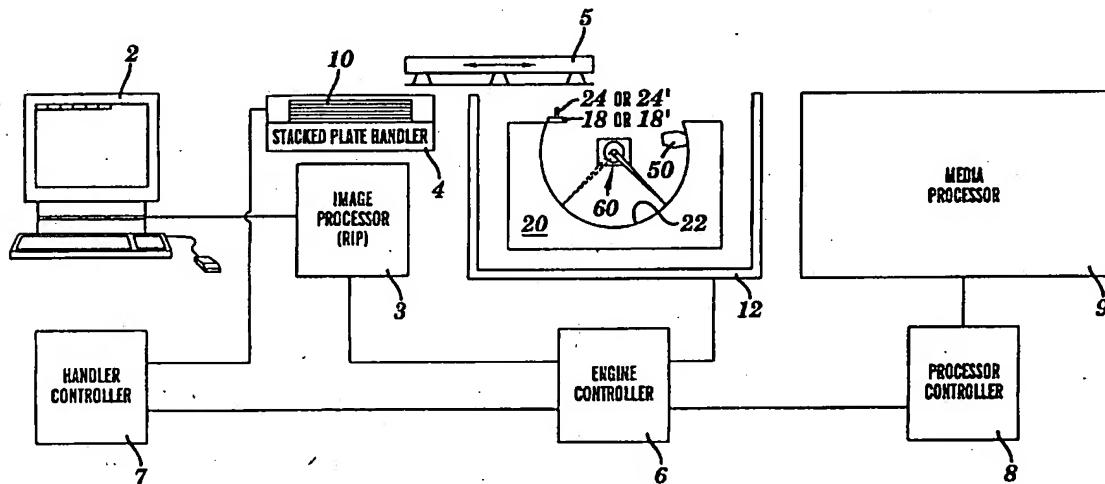


FIG. 1

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member at the point, i.e. the location or position, at which the moveable member contacts the registration member. The registration member preferably has a reference surface, which the moveable member contacts and which is aligned substantially parallel to the edge of the medium with the medium in the set position. By restraining further movement of the moveable member, the medium is positioned at the set position on the support surface.

In accordance with other aspects of the invention, the moveable member is moveable in a direction parallel to the reference surface of the registration member. A drive mechanism, e.g. a carriage assembly, drives the movement of the moveable member parallel to the reference surface. Beneficially, the drive mechanism contacts the reference surface to thereby provide a positioning of the moveable member and the reference surface when the moveable member is not in contact with the edge of the medium.

According to other aspects of the invention, a guide mechanism, connected to the moveable member, guides the movement of the moveable member towards the registration member. A spring is provided to apply a separation force to maintain a separation of the moveable member and registration member when the moveable member is not in contact with the medium edge. Hence, the spring, to some extent, resists the force applied by the medium edge to move the moveable member towards the registration member. In accordance with still other aspects of the invention, the moveable member bar and the registration member are both formed of electrically conductive material. A detection circuit is connected to an electrical power source and to connections at the moveable member and the registration member. The contact of the moveable member with the registration member closes the detection circuit, thereby causing a current to flow within the circuit. The current can be sensed to detect the contact of the moveable member and registration member.

Alternatively and preferably, an optical or other radiation emitter, e.g. a light emitting diode, is arranged to direct a radiating beam between the moveable member and the registration member. An optical or other detector, e.g. a photodetector, detects the radiating beam passing between the moveable member and the registration member. When the moveable member comes into contact with the registration member, the radiating beam is blocked and therefore undetectable by the detector. The failure of the detector to generate a signal can be sensed to detect the contact of the moveable member with the registration member.

#### Brief Description of Drawings

Figure 1 depicts an imaging system in accordance with the present invention.

Figure 2 further details the stacked plate handler depicted in Figure 1.

Figure 3A depicts a registration assembly including the registration pin and registration bar depicted in Figure 1.

5 Figure 3B is similar to Figure 3A but with an edge detector substituted for the left edge registration pin.

Figure 4A is a side view of the movement assembly 26 of Figure 3A.

10 Figure 4B is a front view of the movement assembly shown in Figure 4A.

Figure 5 details a first configuration of the registration pin and registration bar depicted in Figure 1.

Figure 6A details a second configuration of the registration pin and registration bar depicted in Figure 1.

15 Figure 6B is another view of the pin and registration bar of Figure 6A.

Figure 7 depicts the medium deskewing movement after contacting the first registration pin.

#### Best Mode for Carrying out the Invention

20 Figure 1 depicts an imaging system in accordance with the present invention. As shown, the imaging system includes a computer 2 which may be a personal computer, a workstation, or virtually any type of computing device and may form part of an operator control panel. The computer 2 allows images to be created or edited and serves as a general input device. For example, the computer 2 can be utilized to select a particular scanning resolution to be used in imaging during a particular operational sequence.

25 The imaging system further includes a stacked plate handler 4 which is controlled by the handler controller 7. The stacked plate handler 4 stores media 10 of various sizes in different cassettes, as will be described further below. The computer 2 can be utilized by the system operator to input commands identifying the desired plate size. The computer 2 will then generate a signal, responsive to which the handler controller 7 controls the handler 4 such that plates from the applicable cassette within the handler 4 are made accessible to a plate picker 5. The plate picker 5 removes a plate from the handler 4 and conveys the plate to the loading device or applicator 50 of the scan engine 12 which is controlled by engine controller 6.

30 40 45 Images are transmitted from the computer 2 to the raster image processor (RIP) 3 which converts the digitized signals received from the computer 2 into signals which can be understood by the engine controller 6 which controls the scan engine 12. The scan engine 12 includes the plate picker 5 which operates in conjunction with the stacked plate handler 4 and the applicator 50 to move individual plates from the handler 4 to the applicator 50 for loading.

50 55 Once the plate has been loaded onto the mounting surface 22 of the cylindrical drum 20, it is scanned by a scanning light beam radiating from moving scan assembly 60 in accordance with the instructions from the engine controller 6 responsive to the signals received

from the RIP 3. As indicated in Figure 1, the scan engine 12 includes a registration pins 18 or 18' and registration bar 24 or 24' which are utilized to properly position the medium on the support surface 22 of the cylindrical drum 20 during loading. The image is recorded by scanning the light beam parallel to the registration bar 24 or 24'. Recorded media is then transferred to the media processor 9 which is controlled by the processor controller 8 in accordance with signals received from the RIP 3 to develop or otherwise process the imaged plate. The processed plate is then removed from the system.

A subsequent operation may include mounting the plate onto a plate notcher. The notcher may include registration means for registering the leading edge of the plate and transferring the leading edge registration by notching the plate for subsequent mounting onto a press. Alternatively, the plate may be mounted directly onto a press cylinder using the leading edge of the plate for registration. In each alternative, registration means would be located at substantially the same positions as the registration pins of the imaging system. These registration means could be similar to the registration pins 18 or 18' and registration bar 24 or 24'.

Figure 2 provides a more detailed depiction of the handler 4 and individual media cassettes 4a-d. The handler 4 also includes slip sheet remover 4e for removing slip sheets between plates stacked within each cassette. As indicated, the cassettes are movable vertically to position a desired cassette below the plate picker 5 to provide a plate of a selected size. The plate picker 5, using suction devices 5a-5c, lifts the plate from the handler cassette 4b, as shown, and then conveys the individual plate to the applicator 50 of Figure 1 for loading into the cylindrical drum 20. As shown in Figure 2, each of the cassettes 4a-4d stores a different sized plate. The plates in the respective cassettes have different widths. The width, as used herein, is intended to refer to the dimension which, when the plate is loaded onto the support surface of the internal drum, is measured in a direction parallel to the longitudinal axis of the drum, as will be discussed in more detail below.

Hence, the system operator can identify a desired plate size using the computer 2 by, for example, selecting one of multiple plate sizes displayed on a monitor of the computer 2, or inputting a desired plate size or cassette number representing the cassette in which plates of the desired size are stored, to generate a signal to the RIP 3. The signal is transformed by the RIP 3 into an appropriate signal to the handler controller 7. The controller 7 controls the handler 4 in the manner previously described such that plates of the desired size can be conveyed by the plate picker 5 to the applicator 50 of the engine 12.

Figure 3A depicts the cylindrical drum 20 with a sheet of medium 10' loaded therein. The medium 10' has a width W measured parallel to the longitudinal axis X-X of the cylindrical drum 20. The medium 10' is

loaded such that the leading edge 10a of the medium 10' contacts the registration pins 18 or 18' which, as will be detailed further below, are thereby moved into contact with the registration bar 24 or 24'. The medium is left justified at a desired position either against a registration pin 19 or using an edge detector assembly 19'. If a left edge registration pin 19 is utilized, it may be preferable to lot the left side registration pin 18 or 18' with respect to the registration bar 24 or 24'. On the other hand, if an edge detector 19' is used, as shown in Figure 3B, it will be preferable to have both registration pins 18 and 18' adjustable. As shown in Figure 3B, the left edge detector 19' is a large area light detector which is recessed in the drum 20. The detector 19' detects light from the scanning light beam over the portion of the detector now covered by the plate. The detector 19' generates a signal representing the location of the edge of the plate on the detector. The signal is transmitted to the controller 6 which, on the basis of the identified location of the side edge of the plate, begins the imaging a predefined number of scan lines from the edge.

A drive assembly 26 attaches the registration pin 18 or 18' to the registration bar 24 or 24'. In accordance with signals received from the engine controller, the drive assembly moves the registration pins 18 or 18' parallel with the axis X-X of the cylindrical drum 20 to adjust the positioning of the registration pins 18 or 18' on the registration bar 24 or 24' in accordance with the plate size identified on the computer 2. Accordingly, as indicated by the two-headed arrows at each of the drive assemblies 26, each drive assembly 26 can be moved further towards or away from the respective ends of the registration bar 24 or 24', depending upon the selected plate size, to move each of the pins 18 or 18' to a position corresponding to the width of the plate to be imaged.

Figures 4A and 4B detail the movement assembly 26. Figure 4A depicts a side view of the movement assembly. As shown, the assembly includes a stepper motor 100 which drives a gear 200. The gear 200 engages a rack 300 to drive the assembly 26 along the registration bar 24 or 24'. Ball bearings 104a and 104b ride along the bottom surface 105 of the registration bar 26. The ball bearings 104a and 104b are preloaded against the bottom surface 105 of the registration bar 24 or 24' due to the action of a preload bearing 106 which rides along the top surface of the rack 300. It should be noted that the rack 300 is shown to extend only along a portion of the registration bar but could if desired extend along the full length of the registration bar 24 or 24' to provide the greatest flexibility in locating the registration pins. As the stepper motor turns, the gear 200 rotates and propels the assembly 26 along the longitudinal axis of registration bar 24 or 24', which is aligned parallel to the longitudinal axis of the drum 20. Since the bearings 104a and 104b ride along the same lower surface 24b or 24c of the registration bar 24 or 24' which the registration pin 18 or 18' contacts as the register reference,

the alignment of the registration pin 18 or 18' with respect to the registration bar contact surface 24b or 24c is guaranteed. As shown, a light-emitting diode 40 and photodetector 42 can be used, as will be detailed further below, to determine when the registration pin contacts the registration surface. Alternatively, the pin and bar can be arranged in a current detection circuit, as will be described further below.

Figure 5 depicts a first configuration of the registration pin 18 and registration bar 24 which provides information to the engine controller, and hence to the system operator, regarding the proper alignment of the loaded medium. As shown in Figure 5, the sheet of medium 10' being loaded onto the support surface 22 of the cylindrical drum 20 makes contact with the registration pin member 18a which is spring mounted on slide pins 18c. The springs 18b have one end abutting the pin member 18a and a second end abutting the insulating bushings 24a which are installed in an elongated aperture formed along substantially the entire length of the registration bar 24.

The detector circuit 30 is connected to a power source 32, and by a connector 30a to one of the slide pins 18c of the registration pin 18 and by connector 30b to the registration bar 24. The detector circuit 30 also includes a current detector 30c which detects a current through the detection circuit 30 when the pin member 18a of the registration pin 18 contacts the registration bar 24. As indicated, this contact occurs when contact surface 18d of the pin member 18a makes contact with contact surface 24b of the registration bar 24.

Once contact is made, a current flows to the current detector 30c which generates a signal to the engine controller 6 indicative of the registration pin member 18a having moved to a point of contact with the registration bar 24. As will be further discussed below, the detection of the contact between the registration pin 18 and the registration bar 24 can be used to determine if the loaded plate 10' has been properly positioned within the cylindrical drum 20. It should be noted that, using the Figure 5 configuration, even if the medium 10' is formed of a non-metallic material. Hence, an electrical circuit can still be utilized to detect the registration alignment of media on the mounting surface 22 even if the media is not electrically conductive.

Figure 6A depicts an alternative configuration which can be used to ensure proper alignment of the medium 10' on the cylindrical drum mounting surface 22. As depicted, the registration pin 18' includes a registration pin member 18e and slide members 18f. The slide members 18f are mounted to a springs 18g which are designed to allow movement of the pin member 18e towards and away from the contact surface 24c of the registration bar 24'. The slide pins 18f pass through an elongated aperture formed along substantially the full length of the registration bar 24' and are supported by a bushings 24e disposed therein.

A light emitting diode (LED) 40 is provided to emit a

radiating light beam which passes between the registration pin member 18e and the register bar 24' when not in contact. The light is detected by the photodiode 42 which generates a signal to the engine controller 6 indicative of no contact between the registration pin 18' and registration bar 24'. This allows the engine controller 6, and accordingly the system operator, to determine if the medium 10' is properly positioned on the support surface 22 of the cylindrical drum 20 prior to imaging the medium.

As shown in Figure 6B, the LED 40 and photodiode 42 are disposed between the slide pins 18f. As the plate 10' moves in the direction of the arrow, the leading edge of the plate 10' makes contact with pin member 18e and pushes the pin 18' such that the slide members 18f force the springs 18g to be compressed and the contact surface 18h of the registration pin 18' to move toward the contact surface 24c of the registration bar 24'. When the contact surfaces 18h and 24c make contact, the light from the LED 40 is totally blocked such that the photodiode 42 ceases to detect the radiating light. The photodiode 42 therefore stops, generating a signal to the engine controller 6 thereby indicating to the engine controller 6, and hence to the system operator, that the media 10' is in proper registration at the applicable registration pin 18'.

Figure 7 shows the movement of the sheet of medium 10' after contact between the first registration pin 18 or 18' positioned proximate to the right side of the plate 10' with the registration bar 24 or 24', while a second registration pin 18 or 18' proximate to the left side of the medium pin has yet to contact the registration bar 24 or 24', with the medium being moved in the direction indicated by the arrow. As shown, a skew of 0.060 inches exists at the left registration pin 18 or 18' when the right pin 18 or 18' contacts the registration bar 24 or 24'. Accordingly, at this point the media 10 is improperly positioned on the support surface 22 of the drum 20.

Because the engine controller 6 is aware that the left registration pin 18 or 18' has yet to contact the registration bar 24 or 24', the applicator 50 continues to move the plate 10' toward the registration bar 24 or 24'. The plate 10', although restricted from further movement toward the registration bar 24 or 24' on the right side of the plate, is able to slightly rotate about the right side registration pin 18 or 18'. This allows the left side of plate 10' to continue to move, pushing the left side registration pin 18 or 18' up against the registration bar 24 or 24' and thereby eliminating the skew as indicated.

At this point, as discussed above, the engine controller 6 is made aware of both registration pins 18 or 18' being in register with the registration bar 24 or 24' and, accordingly, that the medium has been properly positioned for imaging on the support surface 22 of the drum 20. The engine controller thus processes a signal to indicate that positioning is complete and controls the scan assembly 60 to image the medium. The first scan line impinges upon the plate at the desired predefined

position from the leading edge of the plate and parallel to the registration bar.

As described in detail above, the present invention provides a registration apparatus capable of detecting the proper positioning of media on a medium support surface prior to imaging. The apparatus ensures proper alignment registration of the medium to be imaged as it is loaded onto the medium support surface and whether or not the medium is electrically conductive.

It will also be recognized by those skilled in the art that, while the invention has been described above in terms of one or more preferred embodiments, it is not limited thereto. Various features and aspects of the above described invention may be used individually or jointly. Further, although the invention has been described in the context of its implementation in a particular environment and for particular purposes, those skilled in the art will recognize that its usefulness is not limited thereto and that the present invention can be beneficially utilized in any number of environments and implementations. Accordingly, the claims set forth below should be construed in view of the full breadth and spirit of the invention as disclosed herein.

#### Claims

1. A registration apparatus for positioning a medium (10) on a media support surface (22), comprising:

a moveable member (18 or 18') configured to be contacted by an edge of a medium (10a) and moveable therewith, as the medium is moved to a set position on the support surface; and  
a registration member (24 or 24') configured to restrain the movement of the moveable member at a point at which the moveable member contacts the registration member to position the medium at the set position on the support surface.

2. A registration apparatus according to claim 1, wherein:

the registration member has a reference surface (24b, 24c) aligned substantially parallel to the edge of the medium with the medium in the set position; and  
the moveable member contacts the reference surface.

3. A registration apparatus according to claim 2, wherein:

the moveable member is moveable in a direction parallel to the reference surface.

4. A registration apparatus according to claim 3, fur-

ther comprising:

a drive mechanism (26) for driving the movement of the moveable member parallel to the reference surface;

wherein the drive mechanism contacts the contact surface to thereby provide a fixed relative positioning of the moveable member and the reference surface when the moveable member is not in contact with the edge of the medium.

5. A registration apparatus according to claim 1, further comprising:

a guide mechanism (18c, 24a) connected to the moveable member and configured to guide the movement of the moveable member towards the registration member.

6. A registration apparatus according to claim 1, further comprising:

a spring (18b, 18g) configured to resist the movement of the moveable member towards the registration member.

7. A registration apparatus according to claim 1, wherein the moveable member and the registration member are formed of electrically conductive material, and further comprising:

an electrical power source (32); and  
a detection circuit (30c) connected to the electrical power source, the circuit having a first connection (30a) at the moveable member and a second connection (30b) at the registration member;

wherein contact of the moveable member with the registration member closes the detection circuit.

8. A registration apparatus according to claim 1, further comprising:

an emitter (40) configured to direct a radiating beam between the moveable member and the registration member; and  
a detector (42) configured to detect the radiating beam passing between the moveable member and the registration member;

wherein with the moveable member in contact with the registration member the radiating beam is undetectable by the detector.

9. A registration apparatus according to claim 8, wherein, the emitter is a light emitting diode and the detector is a photodetector.

10. An imaging system according to claim 1, wherein the medium is non-metallic.
11. A method of registering the position of a medium on a media support surface (22), comprising the steps of:
- contacting a moveable member (18 or 18') with an edge of a medium (10a);  
moving the medium, with the medium edge in contact with the moveable member, such that the edge forces a movement of the moveable member as the medium is moved to a set position on the support surface; and  
restraining the movement of the moveable member at a point at which the moveable member contacts a registration member (24 or 24') to position the medium at the set position on the support surface.
12. A method according to claim 11, wherein:
- the moveable member contacts the registration member at a reference surface (24b, 24c) aligned substantially parallel to the edge of the medium with the medium in the set position.
13. A method according to claim 12, further comprising the step of:
- moving (26) the moveable member in a direction parallel to the reference surface prior to the medium edge contacting the moveable member.
14. A method according to claim 12, further comprising the step of:
- maintaining a fixed relative positioning of the moveable member and the reference surface prior to the edge contacting the moveable member.
15. A method according to claim 11, further comprising the step of:
- guiding (18c, 24a) the movement of the moveable member towards the registration member as the medium is moved to the set position.
16. A method according to claim 15, further comprising the step of:
- resisting (18b, 18g) the movement of the moveable member towards the registration member with a force less than a force applied by the medium edge to force the movement of the moveable member.
17. A method according to claim 11, wherein the moveable member and the registration member are formed of electrically conductive material and the contact of the moveable member with the registration member closes an electrical circuit, and further comprising the step of:
- sensing (30c) an electrical current in the closed electrical circuit to detect the contact of the moveable member with the registration member.
18. A method according to claim 11, further comprising the steps of:
- directing a radiating beam (40) between the moveable member and the registration member; and  
detecting (42) the radiating beam passing between the moveable member and the registration member;  
wherein the contact of the moveable member with the registration member blocks the detection of the radiating beam.
19. A method according to claim 11, wherein the medium is non-metallic.

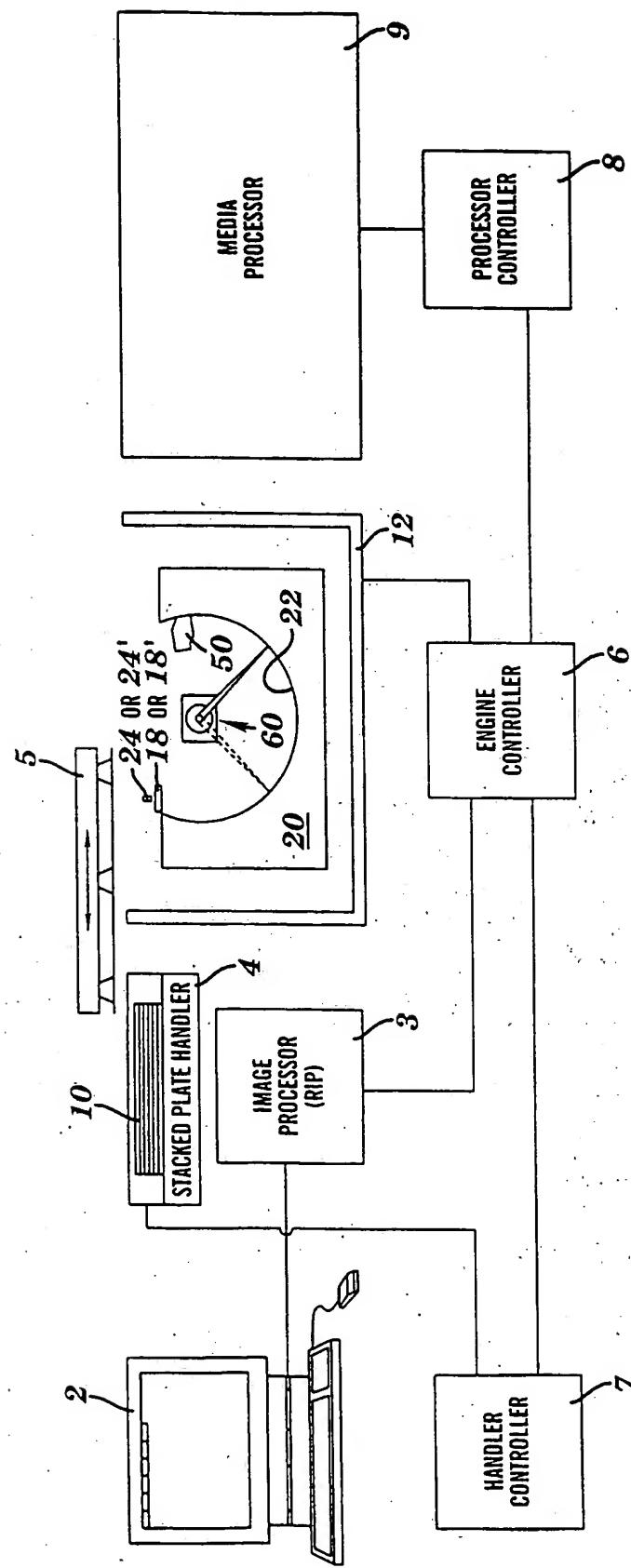
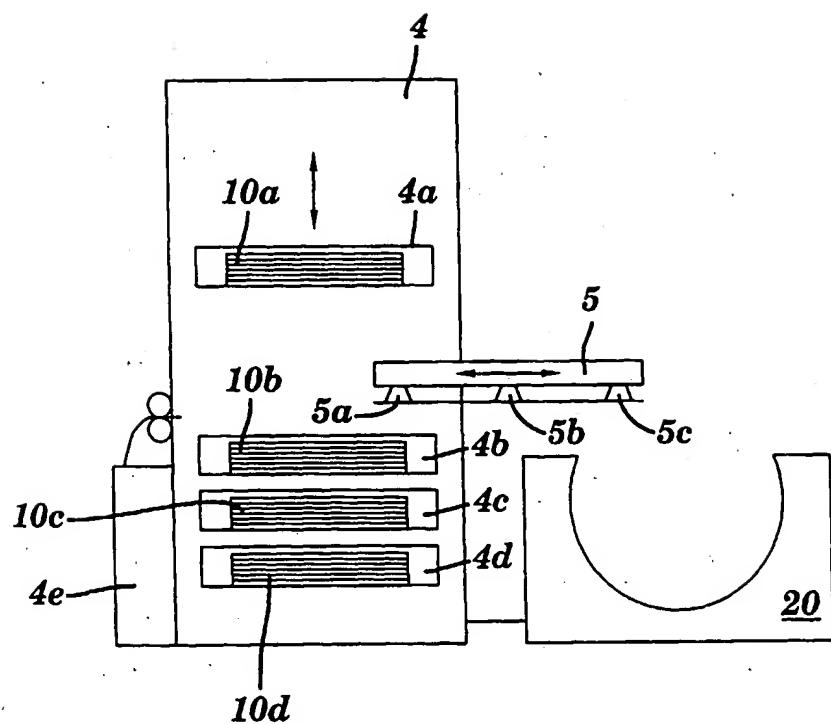
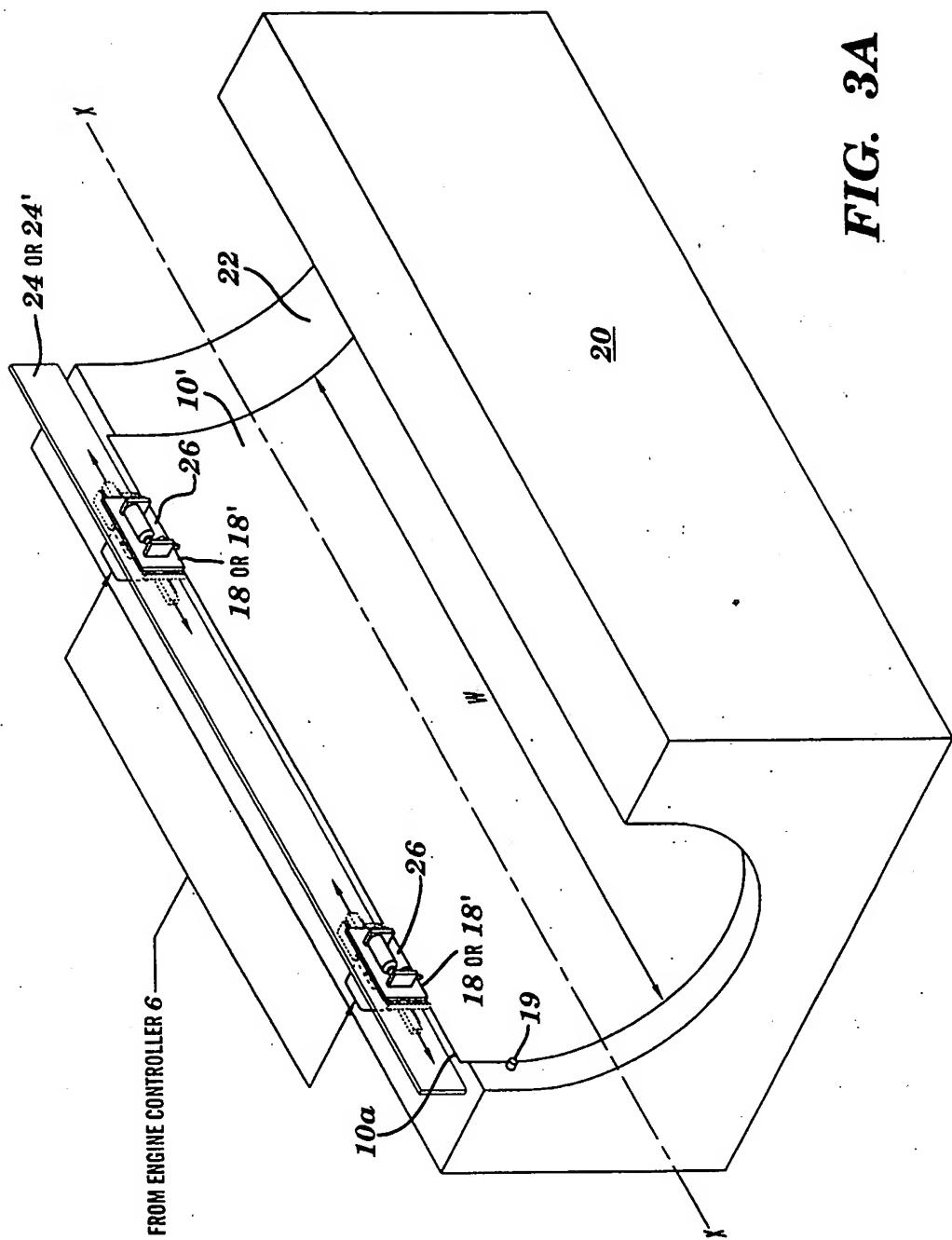


FIG. 1

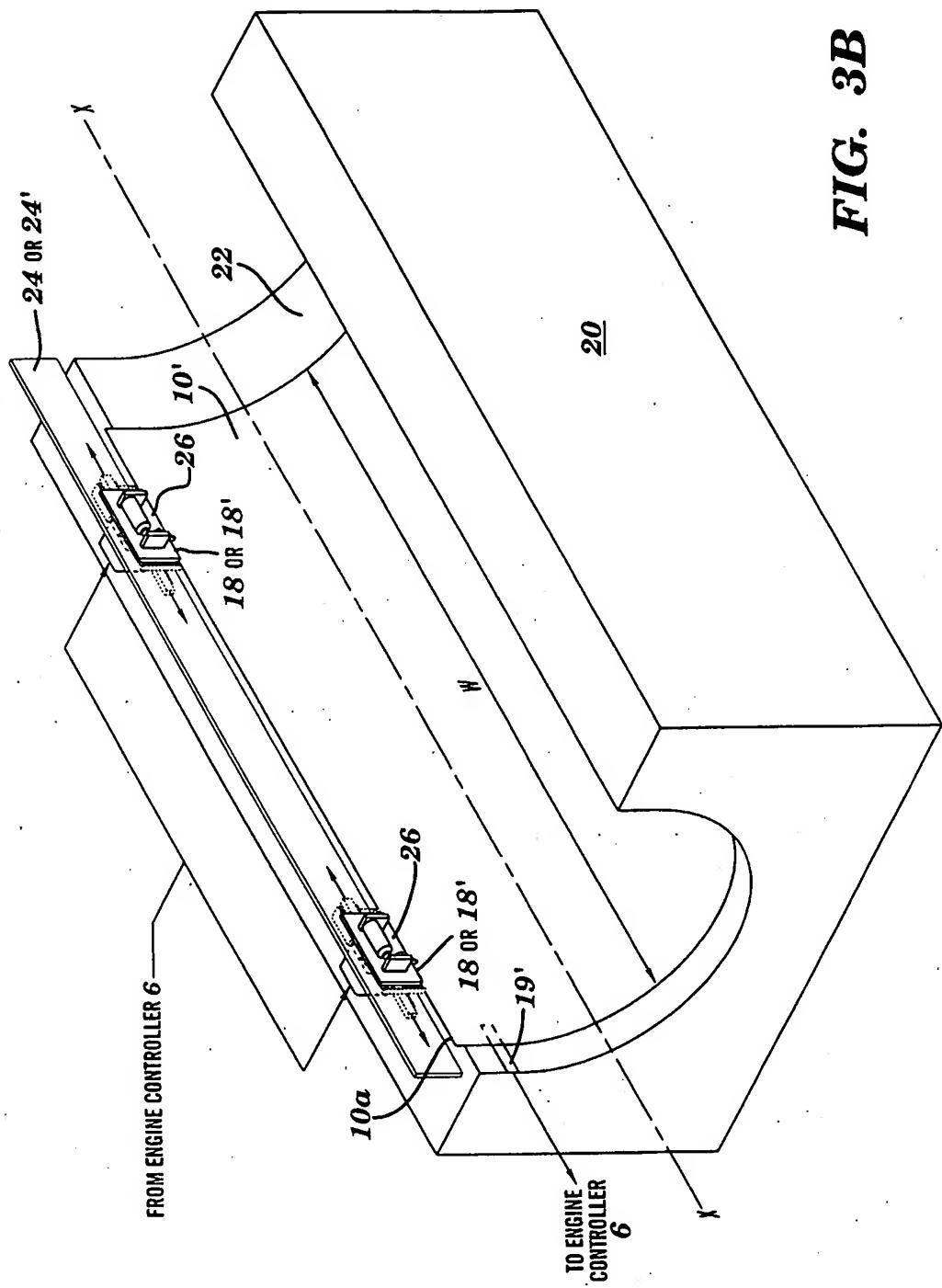


**FIG. 2**

FIG. 3A



**FIG. 3B**



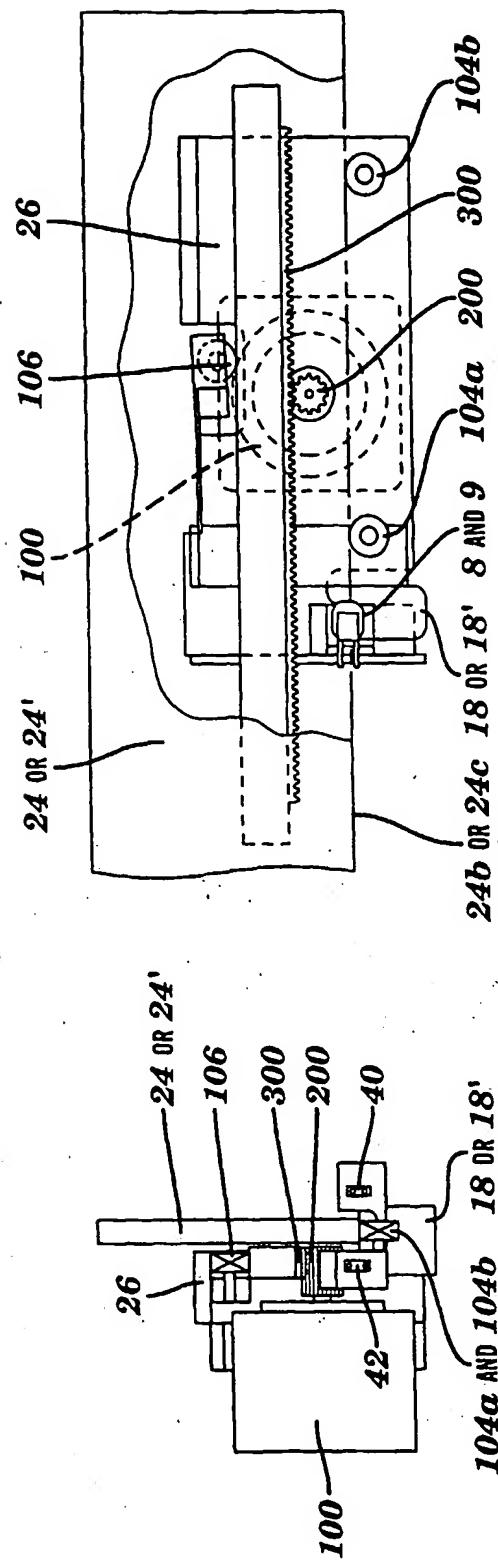
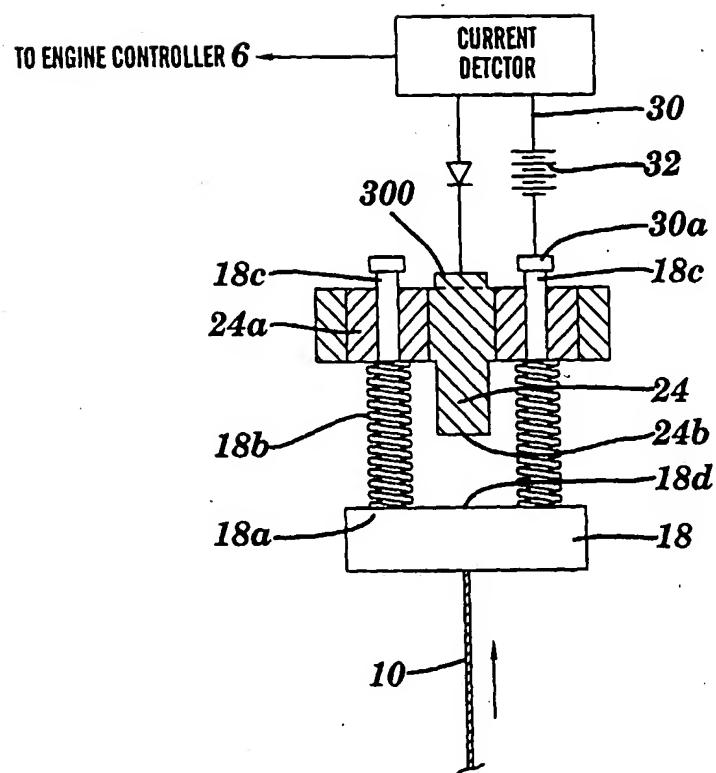
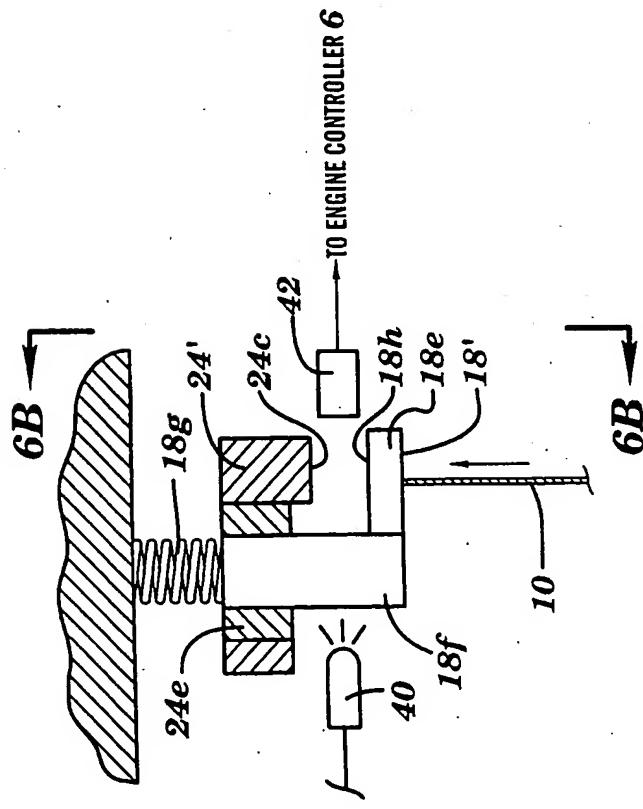
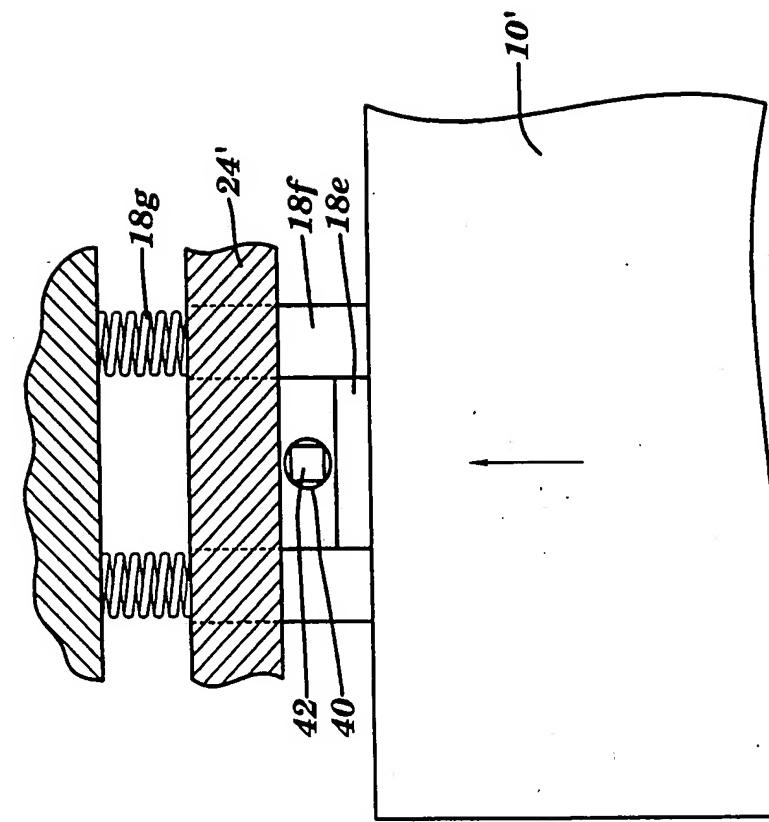


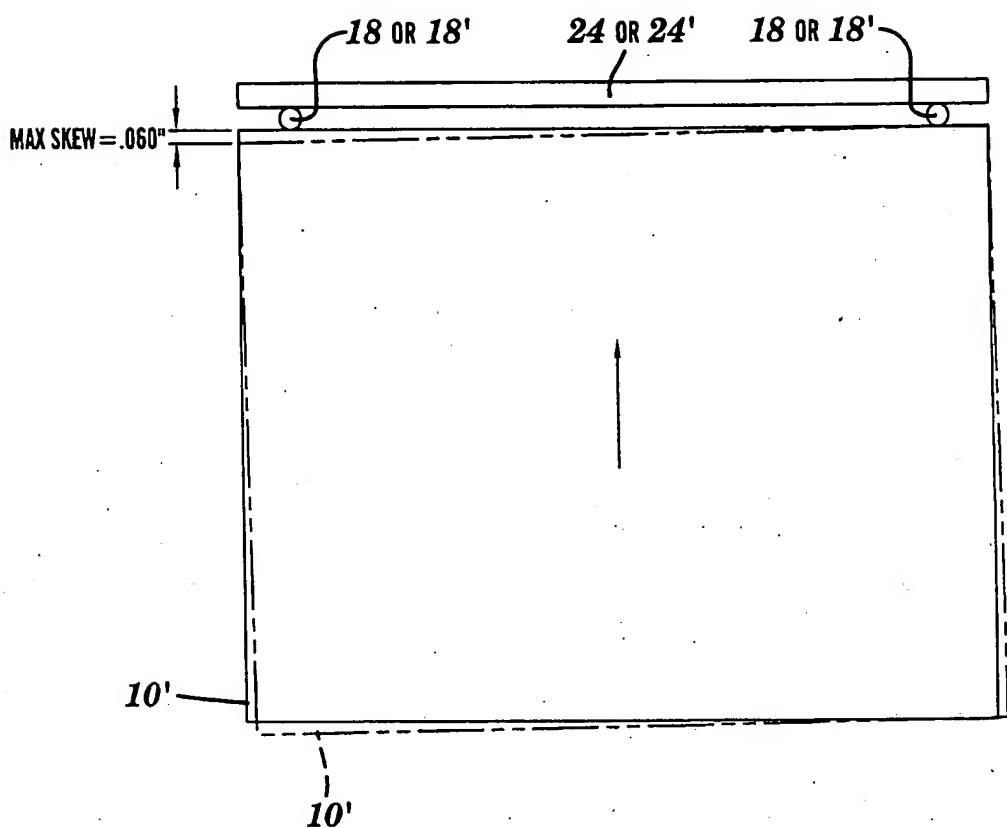
FIG. 4B

FIG. 4A



**FIG. 5**





**FIG. 7**



(19) Europäisches Patentamt

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(11) EP 0 882 581 A3

(12)

## EUROPEAN PATENT APPLICATION

(88) Date of publication A3:  
28.02.2001 Bulletin 2001/09

(51) Int. Cl. 7: B41B 21/32, G03F 7/20,  
H04N 1/08

(43) Date of publication A2:  
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(21) Application number: 98110169.4

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(84) Designated Contracting States:  
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE

Designated Extension States:  
AL LT LV MK RO SI

(30) Priority: 04.06.1997 US 868969

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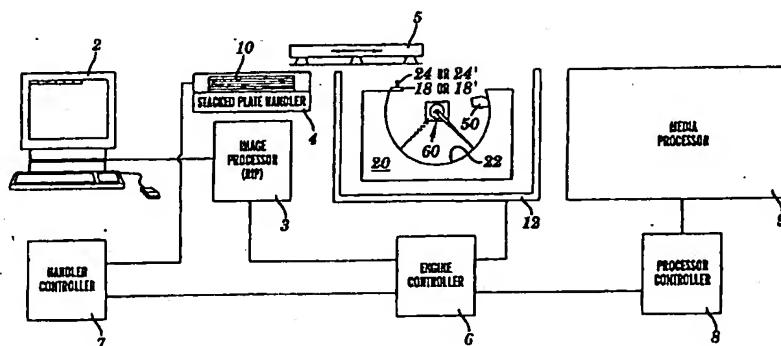


FIG. 1

EP 0 882 581 A3



European Patent  
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## EUROPEAN SEARCH REPORT

Application Number

EP 98 11 0169

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	US 5 619 246 A (MACDONALD TIMOTHY P ET AL) 8 April 1997 (1997-04-08) * column 7, line 33 - column 7, line 53; figures 2,3,6 *	1,3,7	B41B21/32 G03F7/20 H04N1/08
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			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H04N B41B
<p>The present search report has been drawn up for all claims</p>			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	5 January 2001	Madsen, P	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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EP 98 11 0169

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